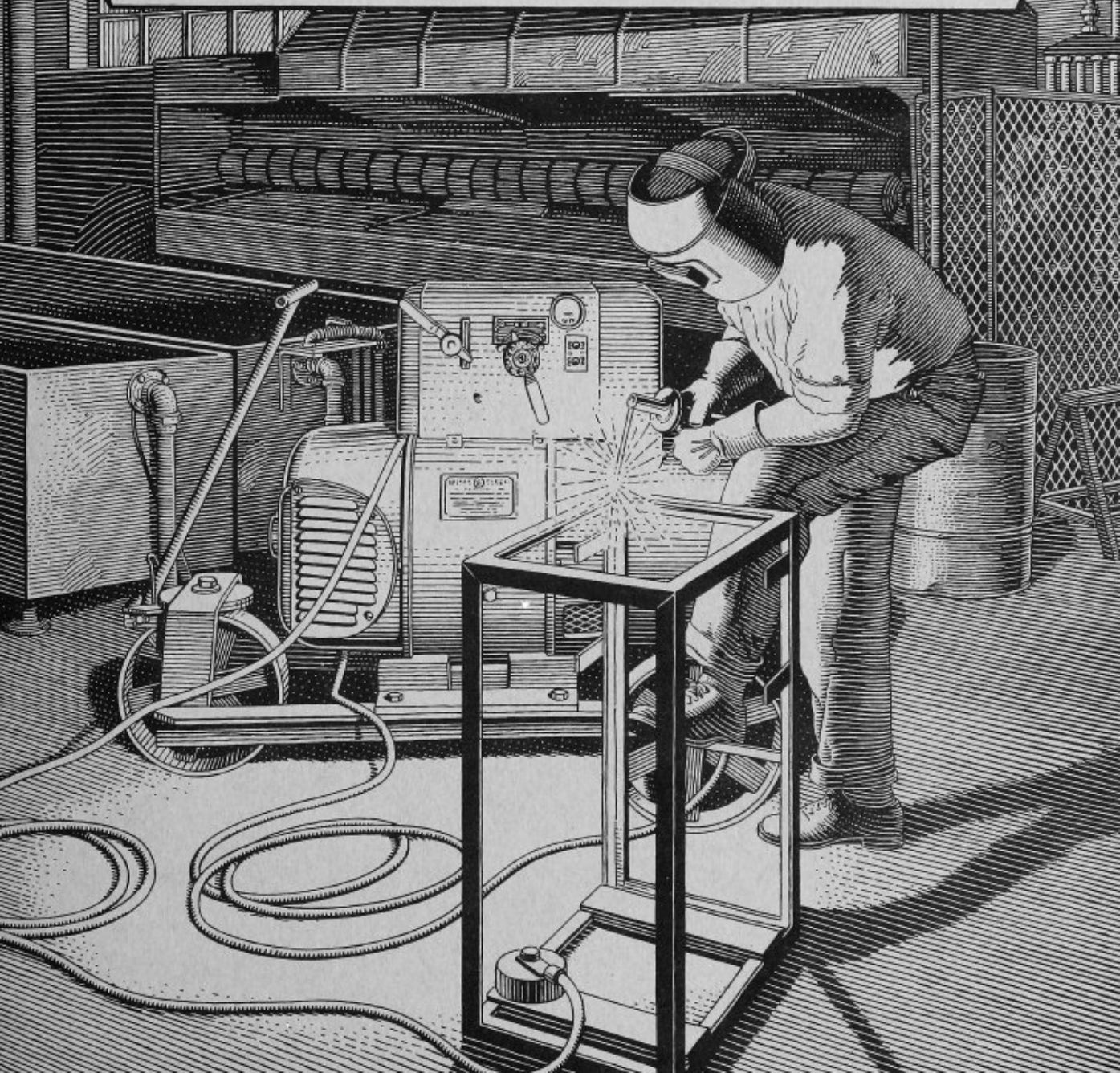


# **ELECTRIC WELDING EQUIPMENT, ELECTRODES, AND ACCESSORIES**



## **ARC WELDING CAN SWELL YOUR PROFITS**

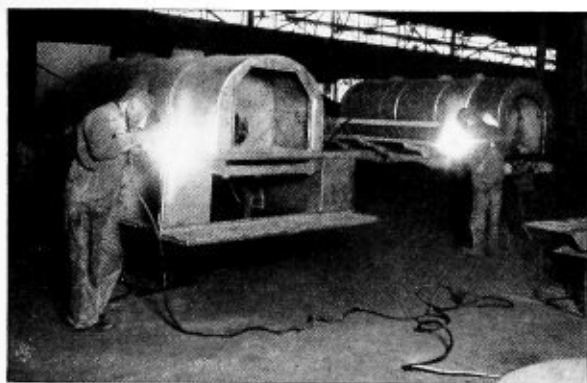
**G**ENERAL ELECTRIC is probably the largest user of arc welding in the United States. It has adapted this method of fabrication and repair to scores of different applications, and in every one of them the result has been substantial improvement in the amount or quality of the product and materially lessened cost.

With this background of investigation and factory experience, General Electric engineers are peculiarly competent to suggest profitable uses for arc welding in your shops. Whether the job be straight quantity fabrication or the repair of worn or broken parts, you can obtain G-E equipment that has been designed—and proved—for that very type of work.

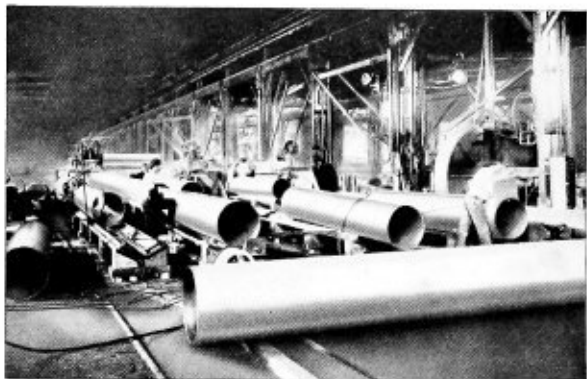
Arc welding is a tool of the widest application. A G-E specialist is ready to help you in a general survey of your processes—to show you just where and how you can profit by installing arc welders, either hand operated or automatic. Stocks of G-E welders, electrodes, and accessories are maintained in G-E welding distributors' warehouses throughout the country.

**GENERAL  ELECTRIC**

## ELECTRIC WELDING



Tank-wagon bodies in process of fabrication—merely one of hundreds of applications of arc welding as a money-saving manufacturing method



Steel pipe fabricated by automatic arc welding. For mass production, the automatic process affords maximum welding speed and minimum cost

**C**OMPETITION in modern industry necessitates either the adoption of any process which will increase either the quantity or quality of its products and, at the same time, show a favorable cost. For this reason, many forethinking manufacturers have already adopted electric arc welding. To mention a few of the more common applications: we find thousands of arc-welded tanks, both large and small; mile after mile of welded pipe lines for oil, water, steam, or gas; a multitude of instances where parts fabricated from rolled steel have replaced castings in the manufacture of miscellaneous industrial products; and arc-welded buildings, bridges, and ships.

Arc welding is not, strictly speaking, a new process. However, prior to the World War it had assumed little importance in industry. The heavy demands made on production equipment between 1914 and 1918 perhaps furthered its adoption as a repair tool on machine parts broken under the stress of unrelenting service. Industrial manufacturers of moderate size often find use for arc-welding equipment, even though they utilize it solely for the repair of broken castings, machine-tool parts, etc., but soon they find that it serves as a true production tool as well as a repair tool. Such has been the experience of those who pioneered in the use of arc welding.

It makes little difference whether the product is a light-gauge steel tank or a fabricated structure assembled from the heaviest shapes, arc welding is at your service. The process is by no means limited to any particular field—rolled shapes, malleable iron, wrought iron, cast iron, cast steel, and steel forgings can nearly always be welded successfully. Then too, special steels—high-carbon steel, chrome steel, nickel steel, etc.—can often be arc-welded to good advantage. Also, arc welding is not limited to the ferrous-metal field, for industry has successfully arc-welded aluminum as well as brass, bronze, monel metal and other alloys under certain conditions.

Wherever the demands of production necessitate the fabrication of a considerable number of units, arc weld-

ing will demonstrate to best advantage its utility as a production tool, because it is at this point that consideration can be given to automatic arc welding. This process permits the highest development of steel fabrication, combining not only the advantages of speed of operation and uniform quality of work, but also those of economy. The application of scientific machine methods, together with the elimination of the personal element, which is of necessity present in hand-welding operations, makes automatic arc welding, when applicable, an ideal manufacturing process.

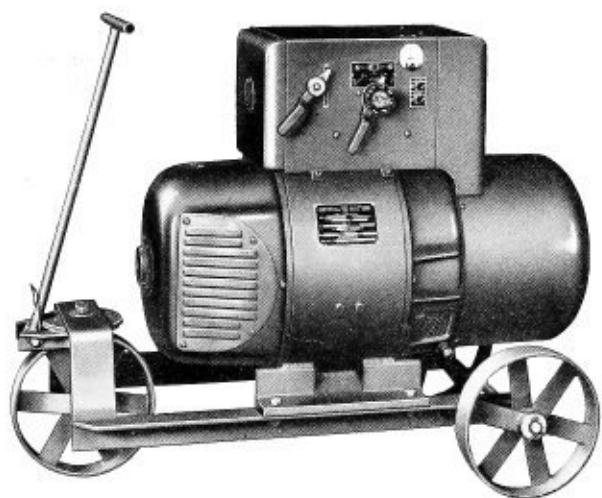
It is true that for both hand and automatic arc welding, changes in design must often be made. Nevertheless, the wealth of data now available for designers facilitates such changes in design to a high degree, and it will often be found that representative savings made, because of the adoption of the arc-welding process to replace castings, will pay in a few weeks for the cost of changing design.

In the field of railroad maintenance and repair, the economy of arc welding has been definitely established. Arc welding has enabled railroads to effect substantial savings in locomotive and car shops. Both hand and automatic welding are used. Arc welding has been employed during the last two or three years for the building up of battered rail ends on many large trunk lines. These railroads are finding that the life of such reconditioned rails may be extended five or more years under ordinary traffic conditions. Arc welding is also used in the construction of railroad bridges and other structures. It likewise lends itself advantageously to the repair and reconditioning of existing structures.

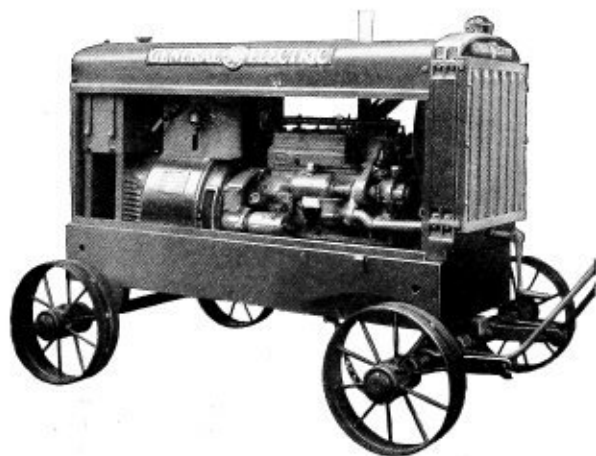
Of noteworthy interest is the utilization of arc welding in the field of building construction. An increasing number of municipalities have adopted building codes including arc welding as an accepted method of construction. Savings are effected, and the public enthusiastically approves of the silence of arc welding as compared with the noise of riveting. Particularly is this an important factor in crowded metropolitan areas.



# SINGLE-OPERATOR, DIRECT-CURRENT ARC-WELDING SETS, TYPE WD



Typical portable motor-driven arc welder, Type WD



Gas-engine-driven arc welder (side covers removed) with steel-tired running gear

General Electric single-operator arc-welding sets, Type WD, offer the owner unexcelled performance throughout the entire welding range with all types of electrodes—bare, lightly fluxed, and heavily coated. This is the result of adequate self-stabilization obtained, not by the use of an external resistor or reactor, but by a unique construction by which stability is made an inherent characteristic of the generator itself. Ease of operation and decreased operating costs result from this self-excited, self-stabilized design.

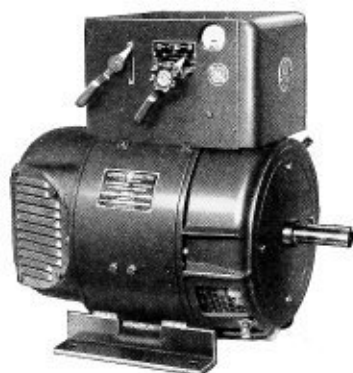
Both electric-motor-driven and gasoline-engine-driven sets and welding generators with control for either direct connection or belting to the purchaser's source of motive power are available in the ratings listed on the following page.

Single-operator welding sets are sold net, f.o.b. factory, freight allowed to destination. When a standard set of welding accessories is purchased with a welding set, freight is also allowed on the accessories.

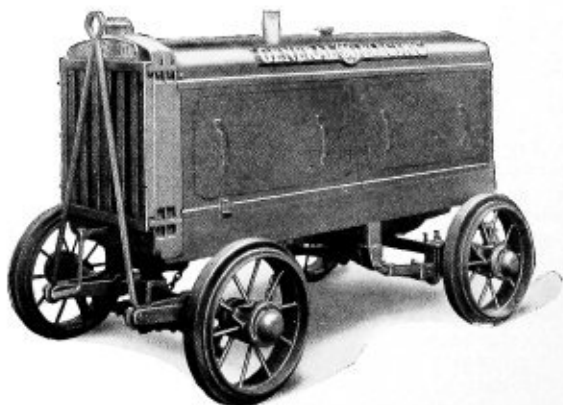
These standard welding accessory sets are priced at \$40.00. They consist of the following items of a size suitable for the welding set with which they are to be used:

- 1—Electrode holder with 5 feet of extra-flexible cable
- 2—30-foot extension cables with terminals
- 1—Welder's helmet
- 1—Wire scratch brush
- 50 Lb. G-E welding electrodes, assorted sizes

In addition to the equipment listed, General Electric can furnish two-operator Type WD sets driven by either electric motors or gasoline engines. These consist of two Type WD generators connected either to a single motor or engine. Prices of special equipments can be obtained from the nearest sales office.



Type WD arc-welding generator arranged for belt drive



Gas-engine-driven welder with steel-tired running gear and leaf springs

## SINGLE-OPERATION ARC-WELDING SETS

## Type WD

## N.E.M.A. Standard

Sizes 100, 200, 300, 400, and 600 Amp.  
1-hr., 50 Deg. C. (Normal)

Stationary and Portable

Power Supply		Generator Amperes  Min.—Max.	Full- Load Speed Rpm.	Motor Amperes at 220 Volts, A-c. 230 Volts, D-c. Generator at Rated Load	PRICE		Approx. Dimensions in Inches						NET WT. IN LB.	
					Station- ary	Porta- ble	STATIONARY			PORTABLE			Station- ary	Porta- ble
							L	W	H	L	W	H		
A-c. Sets; Two Bearings														
100 Amperes—Type WD-21—25-volt Arc														
D-c. Sets; Two Bearings														
3- or 2-phase; 220, 440, or 550 volts	60 cy. .... 50 cy. .... 25 cy. ....	30-125 30-125 30-125	1750 1440 1440	17 17 17	\$375 395 425	\$390 410 440	41 41 43	22 22 22	28 28 28	41 41 43	23 23 23	31 31 31	740 740 765	920 920 945
D-c., 115 or 230 volts		30-125	1750	29	485	500							950	1030
*D-c., 550 volts		30-125	1750		535	550							975	1060
†Belt-driven		30-125	1750		325								995	
A-c. Sets; Two Bearings														
200 Amperes—Type WD-32—40-volt Arc														
D-c. Sets; Two Bearings														
3- or 2-phase; 220, 440, or 550 volts	60 cy. .... 50 cy. .... 25 cy. ....	60-250 60-250 60-250	1750 1440 1440	40 40 40	\$550 570 625	\$565 585 640	41 41 42	24 24 24	34 34 34	55 55 56	33 33 33	43 43 43	1230 1230 1310	1390 1390 1470
D-c., 115 or 130 volts		60-250	1750	67	660	675	45	24	34	59	33	43	1470	1630
*D-c., 550 volts		60-250	1750		710	725	47	24	34	61	33	43	1645	1805
†Belt-driven		60-250	1750		435		34	24	34				995	
A-c. Sets; Two Bearings														
300 Amperes—Type WD-33—40-volt Arc														
D-c. Sets; Two Bearings														
3- or 2-phase; 220, 440, or 550 volts	60 cy. .... 50 cy. .... 25 cy. ....	90-375 90-375 90-375	1750 1440 1440	56 56 56	\$645 665 720	\$660 680 735	44 44 46	24 24 24	34 34 34	56 56 58	33 33 33	43 43 43	1435 1435 1590	1595 1595 1750
D-c., 115 or 230 volts		90-375	1750	86	845	860	50	24	34	62	33	43	1840	2000
*D-c., 550 volts		90-375	1750		895	910	51	24	34	64	33	43	1910	2070
†Belt-driven		90-375	1750		590		37	24	34				1190	
A-c. Sets; Two Bearings														
400 Amperes—Type WD-34—40-volt Arc														
D-c. Sets; Two Bearings														
3- or 2-phase; 220, 440, or 550 volts	60 cy. .... 50 cy. .... 25 cy. ....	120-500 120-500 120-500	1750 1440 1440	70 70 70	\$795 820 895	\$810 835 910	48 48 49	23 23 23	36 36 36	59 59 59	33 33 33	44 44 44	1725 1725 1825	1885 1885 1985
D-c., 115 or 230 volts		120-500	1750	115	1010	1030	54	23	36	64	33	44	2145	2305
*D-c., 550 volts		120-500	1750		1060	1080	54	23	36	65	33	44	2390	2550
†Belt-driven		120-500	1750		645		41	23	36				1430	
A-c. Sets; Two Bearings														
600 Amperes—Type WD-36—40-volt Arc														
D-c. Sets; Two Bearings														
3- or 2-phase; 220, 440, or 550 volts	60 cy. .... 50 cy. .... 25 cy. ....	180-750 180-750 180-750	1750 1440 1440	112 112 112	\$970 995 1120	\$985 1100 1135	63 63 63	24 24 24	36 36 36				2250 2250 2500	2500 2500 2500
D-c., 230 volts		180-750	1750	172	1295	1310								
*D-c., 550 volts		180-750	1750		1345	1360								
†Belt-driven		180-750	1750		825									

## Gasoline-engine-driven Sets—40-volt Arc

GENERATOR RATING				Gasoline Engine											
Normal, 1-hr., 50 Deg. C.	Type														
200 amp.	WD-32	60-250	1750	Buda H-205, 43 hp.	\$1093	See table below	79½	29½	41	79½	29½	54	2448	2258	
300 amp.	WD-33	90-375	1750	Buda J-214, 47 hp.	1345		89½	29½	46	89½	29½	62½	2825	3125	
400 amp.	WD-34	120-500	1750	Buda H-298, 60 hp.	1495		98½	29½	46	98½	29½	62½	3215	3515	
600 amp.	WD-36	180-750	1750	Buda K-428, 72 hp.	1895										

\* For 400/550-volt d-c. operation, add \$50 to price of set.

† Belt-driven units include generator, generator-control panel, and pulley. Pulley may be omitted at \$4. If pulley is required, order must so specify; otherwise set will be shipped less pulley.

Generators that will meet N.E.M.A. Standards can be supplied on request for either 1440 or 1750 rpm. without change in price. Order must specify speed required.

Standard direction of rotation is counter-clockwise, facing commutator end. Either clockwise or counter-clockwise rotation can be supplied but must be specified.

Standard set of accessories (see Page 316).....Price, \$40.

Motor-driven sets completely assembled include the following: Generator, motor, motor starter, and generator-control panel.

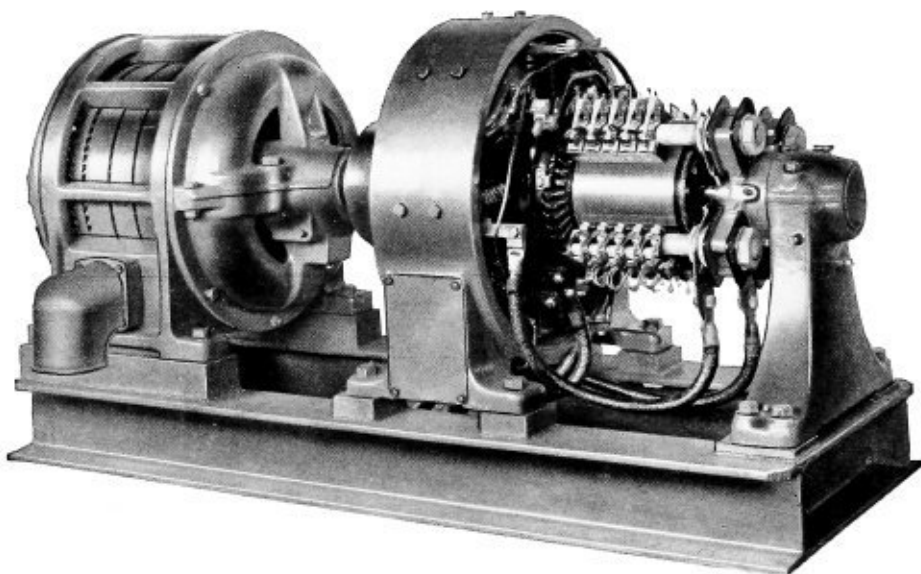
Gasoline-engine-driven sets completely assembled include the following: gasoline engine and its accessories, generator, generator-control panel, slow-down device for idling, and an all-steel canopy.

## Portable Features for Gasoline-engine-driven Sets

Add the following prices to the prices of stationary gasoline-engine-driven welding sets as listed above.

Welding Set	PRICE ADDITION				
	Running Gear with Steel Wheels	Running Gear with Solid Rubber Tires and Sand-rims	Spring-mounted Running Gear with Solid Rubber Tires and Sand-rims, or Pneumatic Tires	High-speed, 2-wheel, Spring-mounted Trailer with Pneumatic Tires	Trailer as Manufactured by Highway Trailer Company
WD-32, 200-amp. unit	\$75	\$150	\$175	\$175	\$525
WD-33, 300-amp. unit	75	150	175	175	525
WD-34, 400-amp. unit	75	150	175	175	525
WD-36, 600-amp. unit	75	150	175	175	640

## MULTIPLE-OPERATOR, CONSTANT-POTENTIAL ARC WELDERS



A 750-amp., multiple-operator, constant-potential, arc-welding motor-generator set

Certain applications, notably the fabrication of metal products on a production basis, require arc welding to be done simultaneously by several operators, by automatic-welding equipment, or by both. For these applications, G-E constant-potential, multiple-operator arc-welding equipment is an economical, dependable, satisfactory source of welding current.

The intermittent nature of the welding load and the diversity factor resulting from the multiplicity of outlets allows the use of a constant-potential generator of a rating lower than the aggregate of the ratings of the number of single-operator sets necessary for the same work.

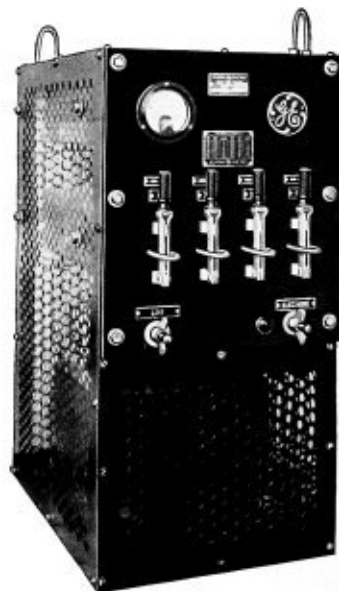
G-E constant-potential sets are available with either a-c. or d-c. driving motors. Where a-c. drive is used, a synchronous motor often offers a profitable means of power-factor improvement.

Standard equipments are flat-compounded at 60 volts and are available in 500-, 750-, 1000-, and 1500-ampere capacities. Other ratings, up to and including 2500-ampere capacity, are available on special order. In deciding upon the size of a set for a particular installation, the following factors must be considered:

1. The number of operators.
2. The maximum current used by each operator.
3. The load-factor, which is a measure of the continuity of service.

(An average load-factor for manual welding is 50 per cent, while for automatic welding it may be around 75 per cent.)

G-E constant-potential welders comprise, in addition to the motor-generator set, a generator panel, rheostat, and motor starter. A complete equipment requires, in addition, a suitable resistor at each welding station to



Resistor-reactor combination

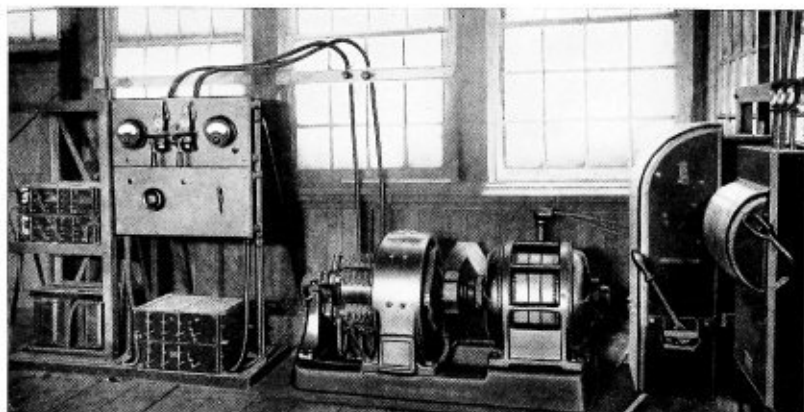
reduce the supply voltage to the correct value for welding. This resistor equipment varies in design, depending upon whether welding is being done with carbon electrodes, or bare or coated metallic electrodes, and upon the welding current required. A stabilizing reactor should also usually be included. Standard G-E resistor-reactor combinations are available, including an ammeter.

From the complete line of General Electric constant-potential welding equipment, an installation individually suited to your particular needs can be made. When applications lend themselves to this type of apparatus, the user is offered:

- Low capital investment.
- Economical generation of welding current.
- Dependable long-lived units.
- Ideal power source for welding.
- Undivided responsibility by a leader in the industry.

For some installations, the factors to be considered in determining whether to purchase a multiple-operator set or several single-operator sets require careful analysis before recommendations can be made to the best advantage.

Before you make a final decision in the selection of a constant-potential welding set, we recommend that you take advantage of the services of a nearby G-E welding specialist who will assist in a survey of the requirements and recommend the most economical installation.



Typical installation of a 750-ampere multiple-operator, constant-potential arc welder

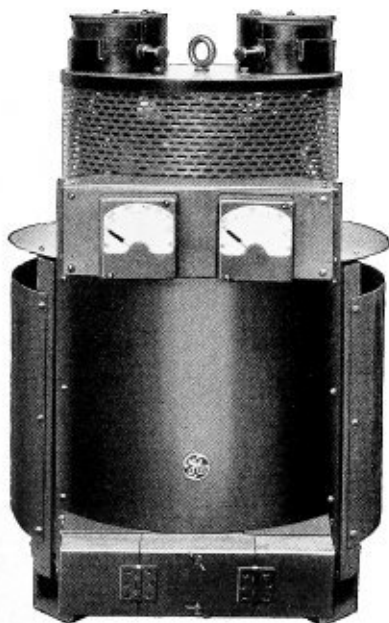
## A-C. ARC-WELDING EQUIPMENT TRANSFORMER TYPE

A-c. arc-welding equipment has a specific field of usefulness supplementary to, but not superseding, that of d-c. apparatus. Its principal applications are found in heavy-current, high-quality automatic welding where welds are to be made in a horizontal or nearly horizontal position. With it, Class I welds in accordance with A.S.M.E. Boiler Code can be readily made. Typical examples of such work are thick-walled pressure vessels and large-diameter high-pressure piping. On some types of work, this equipment is also suitable for hand welding. Furthermore, because magnetic blow is almost completely eliminated, a-c. arc-welding equipment can be advantageously used for making welds of the highest quality in difficult locations—as, for example, in the fabricating of certain machine frames and parts.

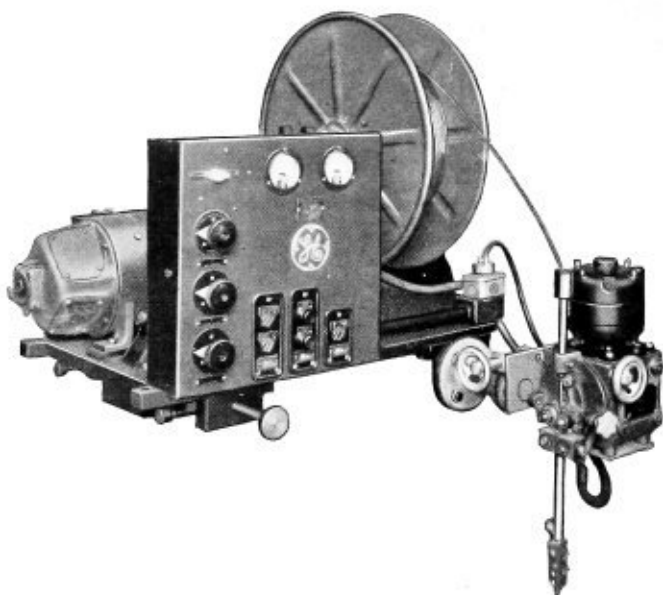
G-E transformer-type welding equipment consists, essentially, of a high-reactance transformer having a current-adjusting reactor mounted integrally with it. A ventilated steel enclosing case permits ample circulation of air for cooling the unit and, at the same time, protects the windings against mechanical injuries.

On top of the unit is mounted a switching device for adjusting the welding current. A sufficient number of operating points is provided so that a current change of approximately five per cent can be made at any point within the range of adjustment. The approximate welding current obtained at each operating point is indicated by a suitable nameplate. Instruments are provided to indicate the voltage and current of the welding circuit.

Standard equipments for operation on single-phase, 25-, 50-, or 60-cycle; 220-, 440-, or 550-volt circuits are available in capacities of 500, 750, and 1000 amperes. These ratings are based on a 40-volt arc and a one-hour temperature rise of 80 deg. C. by resistance.



A 750-amp. transformer-type a-c. arc-welding equipment

**AUTOMATIC-ARC-WELDING EQUIPMENT****For Metallic-electrode Welding**

Typical travel carriage, with automatic-welding head, instrument panel, and electrode reel

In order to weld automatically with metallic electrodes, equipment which will first touch the electrode to the work and then quickly withdraw it to start the arc is necessary. This device must thereafter maintain a constant length of arc by feeding the electrode wire to the weld at the proper speed. G-E automatic-arc-welding equipment does this task automatically, more rapidly and accurately than can even the most expert of operators when welding by hand. The G-E automatic head and control are available either separately or as a part of a complete automatic-welding equipment.

**Automatic-welding Head**

The G-E Type WFA automatic-welding head is an improved device for welding automatically with bare or lightly coated metallic electrodes. Provision is made for using all sizes of electrodes up to and including  $\frac{1}{4}$  in. in diameter.

An operating knob permits quick selection of the desired speed. In accordance with the size of the electrode, the welding current, and the desired arc voltage, the control will automatically adjust the feed to the exact rate of electrode consumption over a wide range for each gear-shift position, three of which are provided.

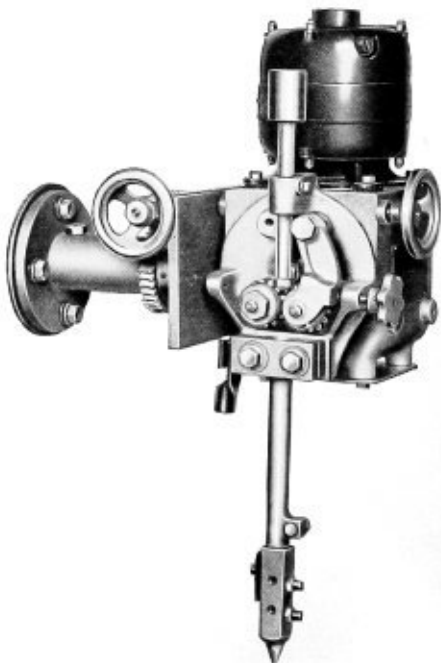
**Control**

The control equipment is compact and dependable. Standard G-E control devices are used throughout. Accuracy is combined with great speed in making adjustments.

**Auxiliary Equipment**

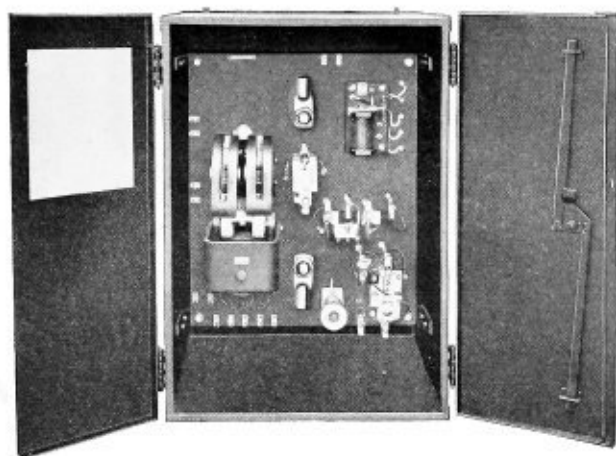
General Electric can supply auxiliary equipment for automatic operation, such as travel carriages, and

rotating machines for welding circumferential seams of circular tanks.



G-E automatic-welding head, Type WFA





Control panel



Instrument panel

### Advantages

The user of properly applied G-E automatic-arc-welding equipment will find that:

#### *Production costs are minimized*

Because good joints are made more quickly and with less expense than by other methods. Drafting is simplified and less costly, and changes can be made effective quickly. Tool costs are reduced to only those required for beveling the edges of the plates, and for simple clamping fixtures to hold the work for welding.

Because welding speeds are faster than with hand welding, since the welding head automatically feeds the electrode at the proper speed and constantly maintains the proper arc for best welding conditions; being mechanical, the equipment never tires and need never rest.

#### *Uniform joints of high quality result*

Because the process is mechanically performed and variations in human skill and efficiency—a source of uncertainty—are eliminated.

Because the equipment can be adjusted to suit any work within its capacity, and will hold this adjustment steadily. Constant accurate control results in dependable uniformity of strength, ductility, and soundness of joint.

#### *Less waste and fewer rejected joints will occur*

Because of accurate control and resultant dependability of the joints. The time required for inspection is minimized, and the spoilage waste is practically eliminated.

Because the electrode waste of hand welding is eliminated, since there are no unused short ends. This saves approximately ten per cent in electrode costs.

#### *Shorter time is required for filling orders*

Because less time is required for engineering and drafting, since the details of products designed for automatic welding are so simplified.

Because the time required to obtain patterns and castings is eliminated. Since less time is required for making joints, production is considerably faster.

#### *Low operating and maintenance costs will result*

Because the field of available labor is considerably broadened. A high degree of skill on the part of the attendant is not required. Men can be trained as automatic-welding-machine operators in a remarkably short time.

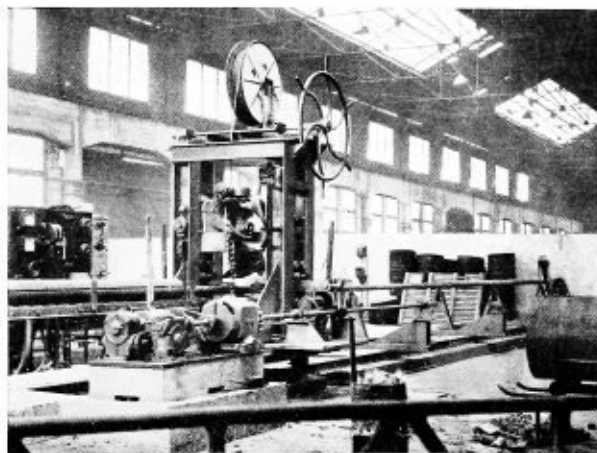
Because every detail of G-E automatic-arc-welding equipment is designed to accomplish its purpose in the simplest manner, and is built to high standards by skilled workmen.

### Typical Applications

1. Storage tanks for gas, oil, or water
2. Steel pipe (5 in. in diameter and larger)
3. Milk cans and ice-cream cans
4. Automobile axle housings and similar parts

In fact, the fabrication, on a quantity basis, of any steel article having relatively long, straight or circular seams, or seams of uniform contour, is a good application for automatic arc welding.

Descriptive publication, GEA-1891.



Automatic-arc-welding equipment for fabricating pipe 5 to 16 in. in diameter and up to 40 ft. in length

## ATOMIC-HYDROGEN ARC-WELDING EQUIPMENT

### Hand or Automatic Operation

For 110-, 220-, 440-, or 550-volt; 50- or 60-cycle; Single-phase Power Supply

#### USED FOR

- General welding of steel, and ferrous alloys, such as chrome, nickel, and molybdenum steels.
- Welding thin sheet metals.
- Repairing tools and dies.
- Welding nonferrous metals and alloys, such as aluminum, duralumin, nickel, monel, copper, brasses, and bronzes.
- Filling-in flaws or blowholes in steel and bronze castings.

#### ADVANTAGES

- Atomic-hydrogen arc welding produces unusually smooth, uniform, strong, and ductile welds.
- Metal of the same analysis as the material being welded can be added by this process.
- The hydrogen gas shields the molten metal from oxidation and reduces surface oxide that may exist on the parent metal.
- In atomic-hydrogen welding, the metals to be joined are fused by the intense heat which results when hydrogen, reduced to the atomic form by passage through an electric arc, reverts back to its molecular form outside the arc. Two tungsten electrodes are used simply as a means of providing the arc, and, while they are slowly evaporated by the intense heat, they do not enter into the weld.

#### HAND-OPERATED EQUIPMENT

The flame is played over the edges to be joined, causing them to fuse together. The actual manipulation of the electrode holder is similar to that of a gas torch used in oxyacetylene welding. On thick stock, a filler rod may be fused into the weld.



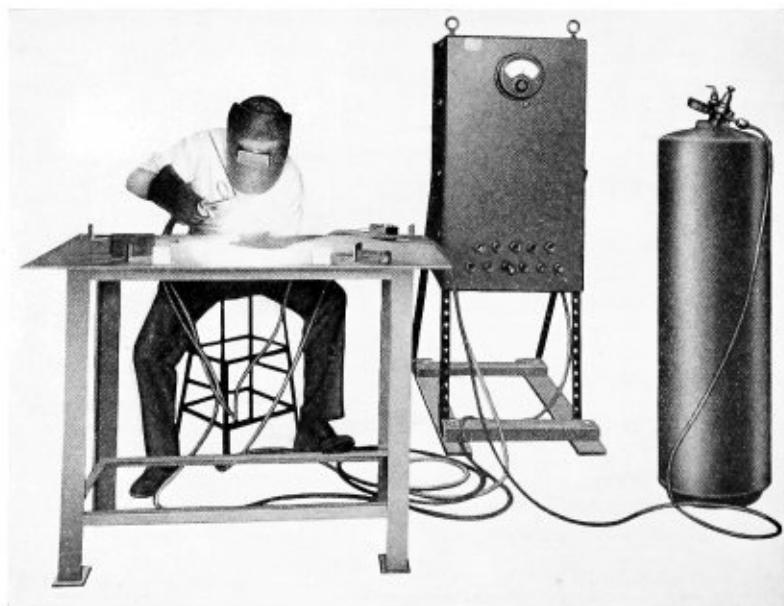
An electrode holder for atomic-hydrogen welding

#### AUTOMATIC EQUIPMENT

Atomic-hydrogen welding can be done automatically, thereby combining the advantages of the atomic-hydrogen process with those of automatic welding. The equipment may include a device for automatically feeding the filler wire.

General Electric can furnish especially designed automatic atomic-hydrogen equipment for any application to which this method of welding is suited.

Further details are given in GEA-823D.

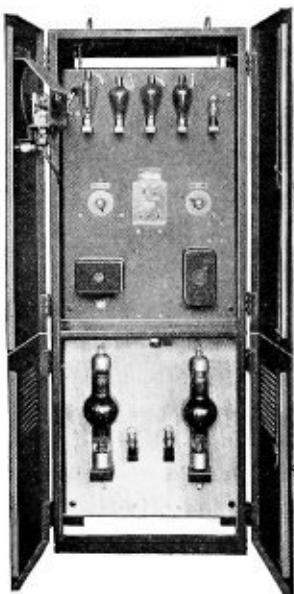


Hand-operated atomic-hydrogen arc-welding equipment

## THYRATRON CONTROL FOR RESISTANCE WELDERS

G-E Thyatron power-tube control for resistance seam-welding equipment permits operation at a greater number of interruptions per minute, and with more consistent repetition of timing, than is possible with mechanical circuit-interrupting devices. Similarly applied to resistance spot-welding machines, it permits more accurate timing; it makes practical extremely short duration of current flow; and it is accurate to the exact number of complete cycles of the power supply, from one cycle up.

The Thyatron synchronous timer accurately controls the time "on" and the time "off" in synchronism with the frequency of the power supply. Transients are minimized when the weld is started at a predetermined point on the voltage wave, and stopped when the current wave passes through zero. By predetermining the closing and opening



Thyatron control panel for resistance welding

points, extreme accuracy of timing results and, in addition, the power consumption and line disturbances are held to the least possible degree.

The accuracy of Thyatron control with the Thyatron synchronous timer makes possible the attainment of consistently good welds without burning or weak spots, and at production speeds previously considered impossible.

G-E Thyatron control for resistance welding permits:

*Extreme accuracy* of timing the duration of the "on" and "off" periods.

*Great flexibility*, permitting adjustment to the most desirable welding cycle.

*Long uninterrupted service*, because of the elimination of moving parts in the power circuit, and the use of vacuum tubes which have proved dependable in service.

*Smooth and efficient operation* of the entire equipment, due to starting and stopping of welding operation at the most advantageous point on the voltage wave.

*Improved quality*, because of ability to time current flow accurately for periods ranging from one cycle of the power supply up to 30 cycles or more.

*Faster production*, because of unerring duplication of the desired "on" and "off" periods.

*Economical operation* through lowered maintenance costs and reduction in percentage of poorly welded rejects.

For further information, see GEA-1679.

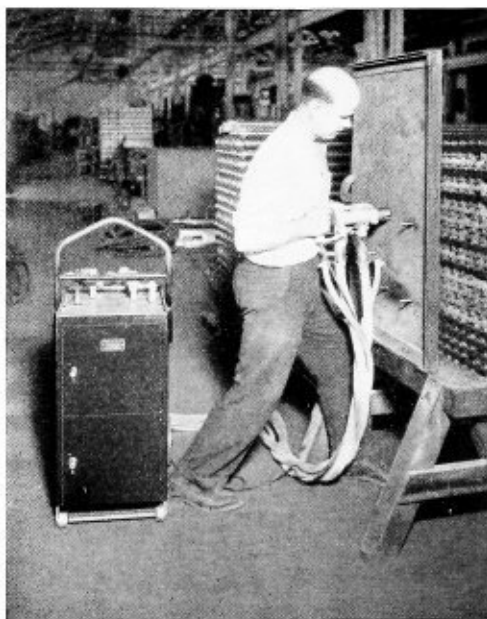
## PORTABLE STUD WELDER

The G-E portable stud welder is a machine for resistance welding studs perpendicularly to a flat surface. It will accommodate studs  $\frac{3}{16}$  to  $\frac{1}{8}$  in. in diameter and  $\frac{1}{2}$  to  $2\frac{1}{2}$  in. in length. One of its important applications is in shipyards where threaded studs for the attachment of fixtures are welded to a vessel's plates in appropriate locations. This saves a great deal of drilling and tapping of holes, and is much faster, and more permanent than bolting.

The stud welder consists of a transformer with a precision timing device and current-interrupting contactor, mounted in a case and provided with wheels for portability.

The stud-welder gun is connected by forced-air-cooled cables to the secondary of the welding transformer. This gun holds the stud in position and furnishes contact to the plate so that the welding current is properly directed. Closing the control switch in the handle of the gun applies one impulse of welding current for the preset interval, ranging from 5 to 50 cycles of the power supply. The welding gun is provided with suitable adapters for handling the various sizes of threaded or unthreaded studs.

Stud-welding equipment can be furnished for any individual application and for other sizes of studs. Further information can be obtained from the nearest G-E sales office.



Portable stud welder in operation

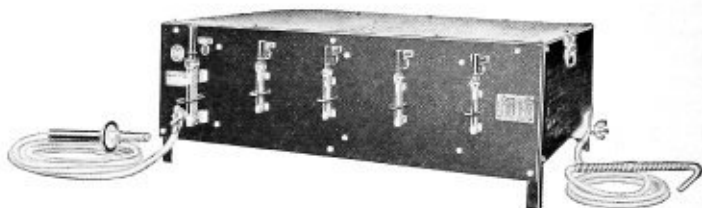
## RESISTOR ARC WELDERS

The maintenance and repair departments of mines and street railways have need of a strong, light-weight, electric arc welder for welding rail bonds and fish plates to rails, for repairing track work, and for odd jobs around the shop. The G-E resistor arc welder, which operates directly from a trolley circuit, is especially designed for this work. It is a light-weight portable machine, inexpensive to buy and easy to operate. The resistance wire is wound on very strong compound insulators, providing rigid support of the resistor units. Reasonable exposure to heat, dampness, rain, cold weather, snow, or sleet will not injure this equipment. Ample material and correct design insure long uninterrupted life.

In addition to the resistor unit itself, a complete equipment includes a trolley hook with suitable lead for connecting to the overhead trolley wire, electrode holder and cable, and either a welder's helmet or welder's hand-shield. A remote-control contactor for control of the welding current, by means of

a foot switch, can be provided if desired. This allows opening the welding circuit in case the operator "freezes" the electrode to the work.

G-E resistor arc welders are provided with suitable resistance units for all of the trolley-circuit voltages generally encountered in mines and elsewhere. Standard units provide currents up to a maximum of 200 or 300 amperes. Special equipments for other applications. For complete description, ask for publication GEA-1031B.



Typical resistor arc welder

## ELECTRIC-BRAZING EQUIPMENT

G-E electric brazing equipment applies regulated heat electrically at the jaws of a pair of clamping tongs. This construction makes it ideal for brazing or hard-soldering brass, copper, bronze, or steel in repair or production work.

A complete equipment consists of:

- 1 Air-cooled, 10-kv-a. single-phase transformer, either 60, 50, or 25 cycles, 220, 440, or 110 volts primary; 8/10/12 volts secondary
- 1 Primary lead 20 ft. long; twin-conductor cable

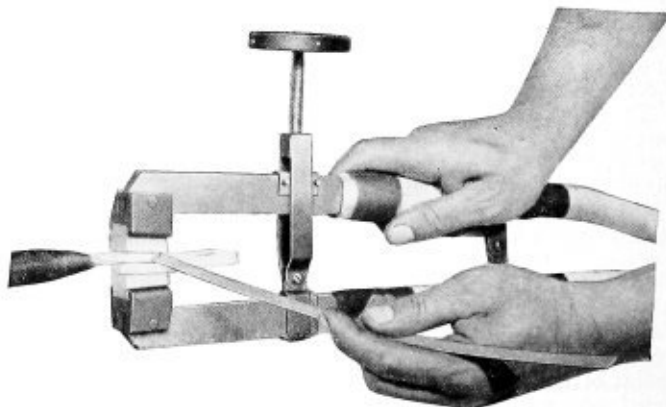
- 1 Primary plug and receptacle
- 1 Foot switch
- 1 Pair brazing tongs with 6 ft. of cable and 6 extra carbon blocks

The transformer may be plugged into any shop outlet of the correct frequency and voltage. The tapped primary winding provides three rates of heating. The standard 10-kv-a. transformer weighs 95 lb. and is designed to carry a heavy momentary overload.

For further details, refer to GEA-1311A.



A 10-kw. electric-brazing equipment













Electric brazing a flat terminal and a stranded cable together with light tongs. A typical joint requires 10 kw. for 10 seconds and 1 in. of silver-alloy strip



## ARC-WELDING ACCESSORIES

General Electric offers a complete line of arc-welding accessories, carefully designed and built of the best materials; selected to make arc welding safe, quick, and easy.

	Material	Cat. No.	Approx. Ship. Wt. in Lb.		Material	Cat. No.	Approx. Ship. Wt. in Lb.
	Electrode holder only; spring-rod type; for electrodes up to $\frac{1}{4}$ in. in diameter and current up to 300 amperes	2648360G3	3		Welder's helmet complete with welder's protective glass, medium shade No. 12, and 1 clear cover glass.	40X159	3
	Electrode holder, similar to Cat. No. 2648360G3, except including 5 ft. of 7/7 (65) 0.005 extra-flexible cable with terminal.	2374436	10		Welder's helmet complete, similar to Cat. No. 40X159, except heavier construction.	261913	4
	Electrode holder only; clamp type; for metallic electrodes up to $\frac{1}{4}$ in. in diameter and current up to 300 amperes.	3854118G1	3		Welder's hand shield complete, including 1 welder's protective glass, medium shade No. 12, and 1 clear cover glass.	40X161	3
	Electrode holder, similar to Cat. No. 3854118G1, except including 5 ft. of 7/7 (65) 0.005 extra-flexible cable with terminal.	3854118G2	10		Welder's hand-shield complete, similar to Cat. No. 40X161, except heavier construction.	261914	4
	Electrode holder only; screw type; for metallic electrodes up to $\frac{1}{4}$ in. in diameter and current up to 400 amperes.	3640144G1	5		Steel-wire scratch brush for cleaning scale and oxide from weld surface.	278715	2
	Electrode holder, similar to Cat. No. 3640144G1, except including 5 ft. of 7/7 (55) 0.007 extra-flexible cable with terminal.	2379244	15		Leather gloves, to protect the operator's hands from both heat and spattering metal.	60X201	1
	"Duro" electrode holder for metallic electrodes $\frac{1}{8}$ to $\frac{1}{4}$ in. in diameter and current up to 300 amperes	61X864	3		Asbestos mitts for the same purposes as the leather gloves above. Preferred for heavy work at high currents.	60X200	1
	Electrode holder only; screw type; for carbon and metallic electrodes up to $\frac{1}{2}$ in. in diameter and for current up to about 500 amperes.	224290	5		Welder's apron of treated 8-oz. duck. Very flexible, yet sufficiently heavy to give long and satisfactory service.	60X203	2
	Electrode holder only; similar to Cat. No. 224290, except for carbon electrodes; up to 1 in. in diameter for current to approximately 1000 amperes.	224289	10		Sleeve protectors of treated canvas.	60X202	1

Parts can be supplied for all of the electrode holders and protective shields listed in the above tabulation.

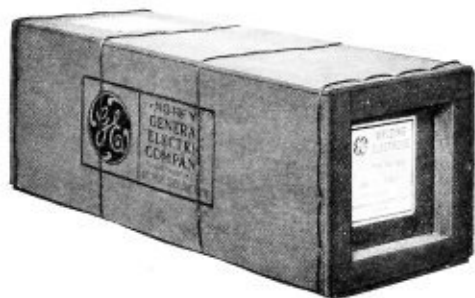
For further description, see GEA-571C.

In addition to the items illustrated and described

above, General Electric can furnish extra-flexible, rubber-covered, multistranded welding cable, with or without terminals or connectors, in any desired sizes and lengths. See Page 390 for description and listing.

## ARC-WELDING ELECTRODES

Of the three factors contributing to a satisfactory weld, that is, the skill of the operator, suitable welding current, and the welding electrode, the electrode is probably the most important. Choice of the electrode will depend upon the work to be done, the equipment to be used, and the results desired.



Standard 50-lb. box of electrodes

The best welding procedure calls for a weld-metal deposit as good as or better than the base metal. The composition, purity, and melting rate of the electrode, and the current and arc voltage suitable for both work and electrode, all affect the penetration and the quality of the deposited metal. Correct penetration assures that the parent metal is correctly melted to receive the metal provided by the electrode.

General Electric has developed a complete line of welding electrodes which includes bare, lightly fluxed, metallic-sheath-covered, and heavily coated electrodes, and is ready to recommend a suitable electrode for each ferrous application, whether manual or automatic.



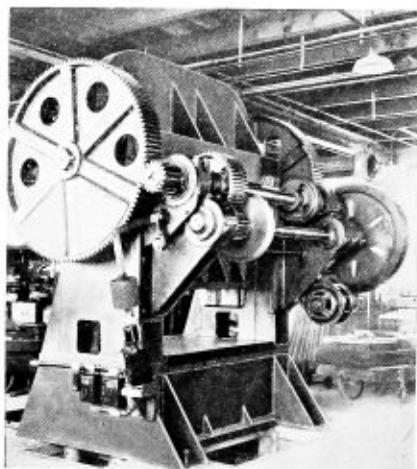
Coil of electrode wire for automatic welding

The characteristics of and suggested applications for each of these G-E electrodes follow briefly. Electrodes are available in cut and straightened 14- or 18-in. lengths, or in 100-, or 200-lb. coils.

### Mild-steel, Bare, and Lightly Fluxed Electrodes for Manual Welding

*Type F.* Smooth, light-red-colored flux coating. Straight-polarity, all-position electrode for general-purpose welding of cast-steel parts, machine bases, and broken frames. Deep penetration, giving unusually strong, ductile, smooth, machinable welds.

*Type H.* White, lightly fluxed and knurled. Requires straight-polarity, d-c. or a-c. High melting rate and arc stability over a wide range of current and arc voltages. High-speed production of sound welds of good appearance.

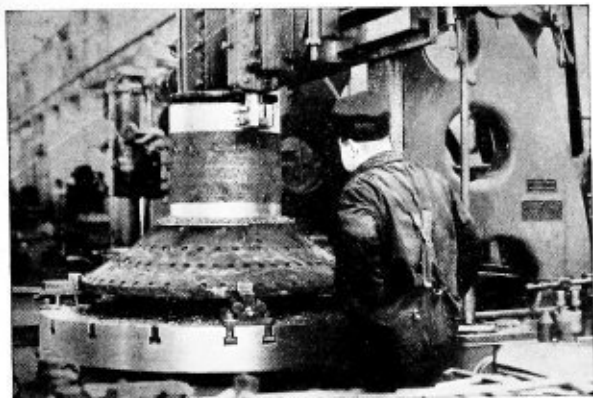


Heavy steel press frame fabricated with Type F electrode



Welding a steel barge with Type L electrode

*Type L.* Brown, sulcoated, straight-polarity electrode. For economical fabrication of buildings, towers, cranes, etc. Uniform quality assures strong, uniform welds which are sound, ductile, and free from slag.



Machining a shaft built up with Type M electrode

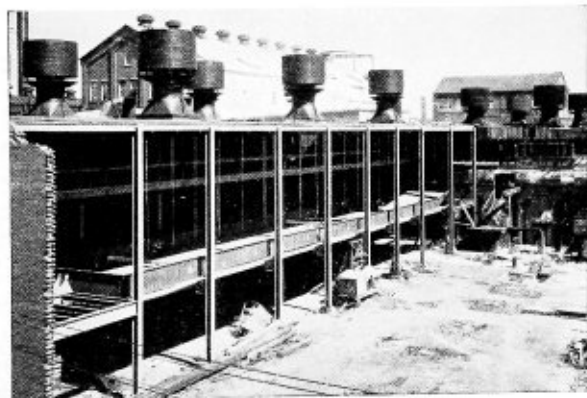


A typical application of Type W-22 electrode

*Type M.* White, lightly fluxed. Straight-polarity all-position electrode, producing close-grained welds of deep penetration, as required for boiler work, flues, light-gauge metal, difficult joints, and the building up of worn shafts.

#### Mild-steel, Heavily Coated Electrodes for Manual Welding

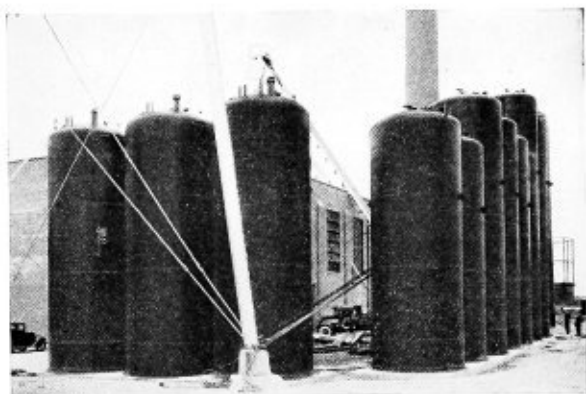
*Type W-20.* Heavy, white flux coating, red spiral tracer. Straight-polarity, d-c. or a-c. For shielded-arc welding, primarily requiring soundness, ductility, and excellent appearance. Economical for all-position welding because of high speed and unusually low spatter loss.



Every weld in this structure is made with Type W-20 electrode

*Type W-22.* Heavy, white flux coating, green spiral tracer. Reverse-polarity, d-c. or a-c. For shielded-arc, general-purpose welding. Produces Class I welds on all types of joints, and in all positions. Exceptional penetration.

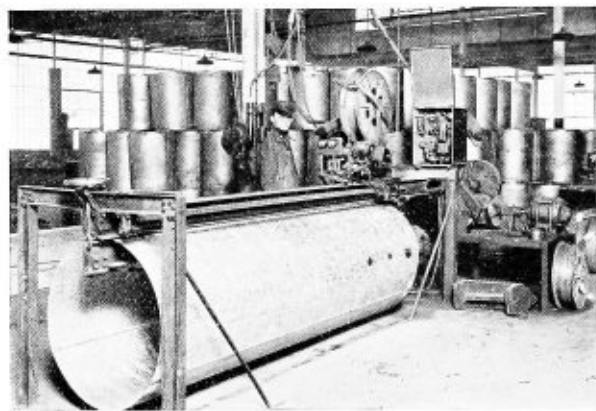
*Type W-23.* Heavy, dark-gray flux coating, red spiral tracer. Reverse-polarity, d-c. or a-c. For shielded-arc flat welding. Gives high-quality, high-speed welds of exceptional tensile strength, ductility, and resistance to impact and corrosion.



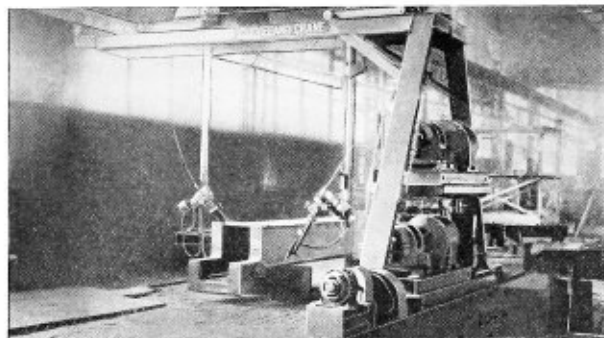
Large tanks, shop-fabricated with Type W-23 electrode

#### Mild-steel, Lightly Fluxed Electrodes for Automatic Welding

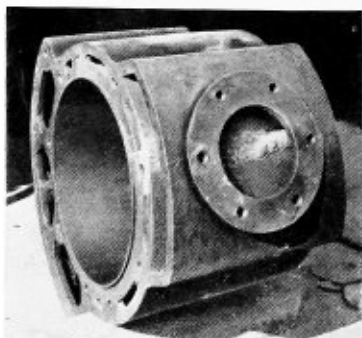
*Type B.* Metallic-sheath-covered with a light flux around the base rod. Straight-polarity, d-c. or a-c. For flat-position welding of black or galvanized iron, such as tanks, range boilers, and milk cans, producing smooth, ductile, easily machinable welds, with freedom from blow holes and piling up of metal.



Welding longitudinal seams automatically with Type B electrode



Illustrating the automatic fabrication of structural shapes with Type F electrode



Cracked cast-iron machine part repaired with Type A electrode



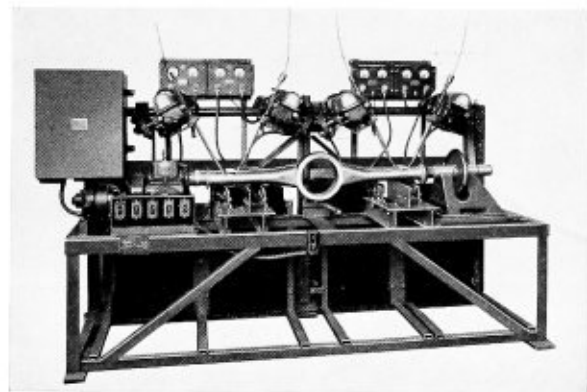
Crossing frog built up with manganese-steel electrode

*Type F.* Described under manual electrodes. Unusual arc stability and penetration make it an excellent electrode for automatic welding, especially for the first passes of multiple-pass welds.

*Type H.* Described under manual electrodes. Knurled and lightly fluxed design adapts it to automatic welding at high speeds. Welding of automobile parts, such as spring pads, torque tubes and axle housings, and tanks, range boilers, etc.

finish. Produces hard-surfaced welds of 450-500 Brinell after cold working.

*Type W-85.* Dark-gray flux coating, reverse-polarity, d-c. or a-c. nickel-manganese electrode. For flat welding, similar to Type W-84. Especially suited to repairing steel parts where thin, narrow deposits and high-quality welds are needed. Often used for the finishing layers of multipass welds where Type W-84 is used for the first passes. Physical properties same as Type W-84.



High-speed welding spring pads to automobile rear-axle housing with Type H electrode



Building up battered rail ends with Type W-90 electrodes

*Types I, L, M, and O.* Also suitable for automatic welding; used under certain conditions instead of the types described above. These electrodes are described elsewhere in this section.

#### Electrodes for Other Applications

*Type A.* Fast-flowing, straight-polarity, metallic-sheath-covered, lightly fluxed electrode for manual welding in flat or vertical positions, either d-c. or a-c. For cast-iron repairing, machine bases, cylinder blocks, etc. Produces strong, sound, tight welds.

*Type W-84.* Bare, smooth-surfaced, reverse-polarity, nickel-manganese electrode for flat welding in reclamation of worn manganese-steel frogs and crossings, and worn or fractured machine parts. Welds are tough, work-hardening, and wear-resisting; require grinding to

*Type W-90.* Heavy, dark-gray flux coating, blue spiral tracer. Reverse-polarity, d-c. or a-c. Flat-position surfacing of battered rail ends. Welds are wear-resistant and work-harden from 40 to 50 points Brinell higher, on the average, than rail steel.

*Type I.* White, lightly fluxed electrode, 0.85 per cent to 1.10 per cent carbon. All-position, straight-polarity. For either manual or automatic welding. For surfacing or building up worn parts where resistance to abrasion is required. Grind to finish.

*Type O.* White, lightly fluxed and knurled. 0.55 per cent to 0.70 per cent carbon, and 0.85 per cent to 1.10 per cent manganese. Either manual or automatic; building up worn surfaces and moving parts requiring weld metal of medium hardness. Welds are reasonably resistant to impact and abrasion. May be finished by machining. Welds in any position with straight polarity,